reaction is negative. While it is true that the lesions in these two diseases in many respects corresponds in particular details, the complete anatomical picture seems to me to indicate that it concerns two distinct diseases.

Certain writers hold that periarteritis nodosa is not a distinct entity because no specific virus as yet has been demonstrated and because various pyogenic microbes have been found in some of the cases (staphylococci, streptococci;) it is also pointed out that preceding infections such as angina, typhoid fever, diphtheria and acute rheumatism may be regarded as predisposing, in some cases at least, to the development of periarteritis nodosa. It is true, as discussed in the earlier part of this article, that arteritis occurs in different forms of infection, but at present the view that the disease is not specific may be regarded as merely hypothetical. To me it seems most reasonable to regard periarteritis nodosa as a definite disease due to a distinct virus. While the clinical picture may be variable, depending on the distribution of the lesions of the arteries, the lesion itself is quite characteristic enough to warrant the belief that it concerns a specific disease. Recently, v. Haun[21] by inoculation of the blood of a patient with periarteritis nodosa claims to have produced the disease in guinea-pigs, but of course further investigation is required.

In conclusion I would point out that forms of true arteritis occur more frequently than usually believed, that they apparently differ etiologically, and that they present anatomical appearances that make the differential diagnosis difficult, this being particularly true of the vascular changes in syphilis, periarteritis nodosa and also in tuberculosis.

POSTOPERATIVE DIETOTHERAPY.[1]

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Prior to the middle of the nineteenth century the dietetic treatment of most acute disease conditions consisted in virtual starvation. Graves, in 1848, first insisted that a fever patient should be fed. Today clinicians are in accord regarding the dietary treatment of febrile conditions. The high calorie treatment of typhoid fever is a

[21] Virchow's Arch., 1920, No. 227.

[1] Read before the Richmond Academy of Medicine, Richmond, Va., February 22, 1921.

more recent development, but its value has been demonstrated beyond cavil. Many a case so treated has on convalescence weighed as much as he had before the onset of his illness, and the frequency of complications has been diminished. In the treatment of lobar pneumonia little attention was formerly paid to dietary regimen. This is a limited disease, usually of one week or of ten days' duration. Physicians believed that for this period the patient could do well on any diet, provided it was light enough, and as a result it usually consisted in liquids of low food value. But pneumonia often, by developing complications, becomes a protracted disease. In this case the diet becomes most important, and those individuals who have been practically starved throughout the first week must continue the fight at a handicap. In the more modern treatment every pneumonia patient is considered as potentially a chronic, wasting case.

The surgeon notoriously pays less attention to dietary treatment than does the internist. In many surgical clinics postoperative treatment still consists in partial starvation. The desire to prevent nausea and vomiting results in undue caution. We do not imply that an individual whose stomach is upset should be fed, but would emphasize that food should not be withheld for several days after the acute gastric symptoms have subsided. A certain number of surgical cases develop complications requiring prolonged treatment. Just as in pneumonia it is essential that every case be treated as potentially of long duration. No harm will be done to those who recover rapidly, and the precaution may be life-saving to those who are so unfortunate as to develop untoward sequelæ.

It is our intention to discuss in this paper only the general dietary management of postoperative cases without reference to those instances in which the presence of complicating medical conditions or operations on digestive organs call for special methods. The latter group is of great importance and merits intensive discussion, but time permits reference only to general dietary principles in surgery.

The treatment of operative cases begins before operation. It is frequently advisable to keep the patient in bed for some days prior to operation, in order to build up the general resistance. A light, highly nourishing diet relatively rich in carbohydrates may be given up through the day preceding operation.

The importance of a liberal fluid intake before operation cannot be overemphasized. Recent studies in the causation of shock bring out the important role played by the fluid content of the blood. The symptoms of shock are due to a deficient amount of circulating fluid in the bloodvessels. In mildly shocked individuals this deficiency follows a draining of blood into abnormally dilated capillary beds, while in severe shock there is added a loss of fluid by transudation out of the vessels into the tissues, due to an abnormal per-

meability of damaged capillary endothelium. The prevention of shock depends in part at least on the maintenance of a normal blood volume. The practice still occasionally in vogue of withholding fluids for some hours previous to operation results in preliminary dehydration and renders the body less able to combat shock when it occurs.

Following operation the patient usually receives nothing by mouth during the first twenty-four hours. During this period the stomach is usually upset and there is a strong tendency to nausea and vomiting. If these symptoms are absent there is no reason for protracted withholding of food. The administration of fairly abundant fluids before operation frequently lessens the tendency to nausea and vomiting. Another precautuon which is frequently successful is that of washing out the stomach while the patient is still under the influence of the anesthetic. As soon as the stomach will tolerate ingested material fluids may be administered. It is best first to try out the patient with water or with weak tea, or if stimulation is necessary, strong coffee. Usually by the second day the patient is in condition to take liquid nourishment. Sometimes this occurs sooner.

The liquid dietary used in most surgical clinics, and also in many even of the more progressive medical clinics, is based upon two essential food substances: milk and raw eggs in the form of egg-white, albumen water or eggnog. Milk is frequently contraindicated in postoperative conditions because of the tendency to distention, and therefore albumen water is often the chief constituent of liquid diets. Scarcely any food substance is less fitted to be the principal article of diet than is uncooked egg-white.

The popularity of this article in treatment arose from the classical work of Beaumont, who found that raw egg-white left the stomach more rapidly than did any other food, and concluded that it was more rapidly digested. Little attention has been paid to more recent work demonstrating that this rapid emptying occurs because raw egg-white is not digested at all in the stomach.

Bateman has summarized the evidence in support of this statement. The outstanding facts are as follows: Raw egg-white has but feeble ability to stimulate the flow of gastric juice. It is actually no more powerful than a similar amount of water. Cooked egg-white, on the contrary, causes the production of an abundant gastric secretion and unites rapidly with the hydrochloric acid. The raw untreated substance possesses an antibody which resists the action of pepsin. Not only is it resistant to digestion in the stomach, but it has also an antitryptic action. It calls forth no increased secretion of bile. After having passed the stomach it is but poorly digested in the intestines. Native egg-white when fed with other easily digestible proteins prevents the digestion and absorption of the latter. This has been proved by numerous investigators. Bate-

man suggests as an explanation that the colloidal egg-white absorbs the trypsin, thus diminishing its activity in much the same way as does charcoal.

Administered by mouth, raw egg-white produces diarrhea and sometimes vomiting in dogs. This has been produced by as small an amount as the whites of two eggs. Diarrhea has also been produced in numerous cases in man even after as small a quantity as the whites of four eggs. Mendel and Louis have shown that after the ingestion of small amounts of native egg-white the latter could be recovered unchanged from the stools. In experimental work it made little difference whether the raw food was eaten alone or with other foods. In the latter case diarrhea was later in appearing. Substances added to the diet which stimulate the flow of gastric juice do not aid in the digestion of egg-white. In man from 30 to 50 per cent of egg-white is completely lost as such in the feces.

Cooked egg-white produces none of these symptoms, and when fed even in large amounts 90 per cent of it is utilized. It is only necessary to produce coagulation. Coagulation is complete with a resultant jelly-like mixture if the temperature is raised to 70°. Heating to a higher point and cooking more thoroughly in no way impairs the digestibility.

Experiments on man consisting of the feeding of raw egg or egg-white produced, as a rule, either diarrhea or flatulence, or both. This sometimes occurred with as small an amount as the whites of four eggs daily. The beating of eggs into a froth made little difference in the result.

Hamburger and Cramer claim that albuminuria follows the ingestion by man of large amounts of beaten egg-white. Stokvis believes that raw egg-white taken in quantity is absorbed and undigested and excreted in the urine, thereby damaging the renal epithelium. Quite recently Van Alstyne has shown that raw egg-white taken into the alimentary tract may enter the circulation and be excreted through the urine.

In spite of the foregoing facts one may find on perusal of current books on dietetics that raw egg-white is still extensively recommended as an excellent nourishing food for invalids.

We may sum up the case against uncooked egg albumen in saying: (1) That it is very poorly digested and absorbed; (2) that as high as 50 per cent is lost in the feces; (3) that it tends to produce gastrointestinal upsets; (4) that at times it appears to produce an albuminuria, a condition certainly not to be desired in postoperative cases in which the kidneys already are overworked, as evidenced by the frequency of albuminuria following general anesthetization. All of these disadvantages are eliminated by the simple process of coagulation.

While egg-white is principally protein the preponderating element in the food of postoperative cases should be carbohydrate. During

operation the metabolism is usually increased and the reserve supply of carbohydrate in the body is to some extent depleted. Carbohydrate should now be administered to furnish additional energy and to protect the patient's own body protein. If protein alone is given the basal metabolism increases as a result of the specific dynamic action of protein. Protein so stimulates the metabolism that the rate of heat formation in the body is accelerated. Sugars and fats have a similar dynamic action, but to a much less marked degree.

Most patients after undergoing an operation and postoperative treatment leave the hospital weighing decidedly less than upon entry. It seems reasonable to hope that under proper dietary care these patients may do equally well as those treated by high calorie, high carbohydrate diets in typhoid fever, and that individuals may leave the hospitals weighing as much as or more than upon entrance. If this is to be attained it can best be done by feeding diets of relatively high caloric value and relatively high in carbohydrates.

It is nevertheless essential that sufficient protein be administered to repair the waste and loss of protein from the body tissues. Chittenden has shown that with slightly less than 1 gram of protein per kilogram of body weight the amino-acid requirements of the tissues will be safely met. The average adult individual weighs about 70 kilograms. With 1 gram of protein necessary per kilogram of body weight the daily diet should then contain approximately 70 grams of protein. This will contribute about 280 calories to the daily requirement, and we must rely upon carbohydrates and fat for the balance. It makes little difference which of these two latter substances preponderates as long as the fat does not furnish more than 90 per cent of the non-protein calories. In view of the tendency to acidosis in postoperative cases, as indicated by the presence of acetone in the urine, it would appear more rational to utilize carbohydrates in preference to fats.

To return to a discussion of the protein it is important to note that recent researches have shown that different proteins vary greatly in their ability to maintain nitrogenous equilibrium. This is because certain ones, such as those from cereals, are deficient in one or more of the essential amino-acids. Van Slyke remarks that a man who might be kept in equilibrium on 4 grams of nitrogen per day in the form of beef, milk or eggs would require 8 grams as bread or potatoes and 16 grams as beans. Thus it would appear advisable when we are giving proteins to give those of higher value, such as meat or meat derivatives, milk, eggs and fish. We must differentiate between proteins of good quality and those of poor quality.

It is not enough that a diet possesses sufficient calories and is composed of the right proportion of foodstuffs. Sufficient vitamines must be present. The food must be palatable. There must be sufficient variation so that the diet will not become irksome. The food must be so prepared that it is easily digested and absorbed.

The physical texture and the fineness of division are factors worthy of consideration. In general the more finely divided the food the more rapidly does the digestive juice penetrate and the more rapidly does digestion take place. Indigestible solids not only act as stimulants to peristalsis but apparently actually retard normal absorption. The method of cooking is important. Fried substances are covered by a layer of material which the gastric juice can neither readily dissolve nor penetrate.

If the diet contains a fairly abundant proportion of milk and of eggs whose albumen has been coagulated there is little danger of deficiency in vitamines, either in the fat-soluble A or in the water-soluble B.

DIET NO. 1.—FEEDINGS EVERY TWO HOURS.

Time.		Amount.	Protein, grams.	Fat, grams.	Carbohydrate, grams.	Calories.
7 a.m.	Hot milk	200 cc	6.0	8.0	10.0	138.40
9 a.m.	Oatmeal gruel	100 cc				
	With milk	100 cc	4.5	4.4	11.3	102.80
	Coffee with cream	25 cc				
	With cane sugar	8 gm.	0.55	10.0	8.75	127.2
11 a.m.	Orange juice	50 cc				
	Lemon juice	25 cc				
	Lactose	50 gm.				
	Water	150 cc	0.4	0.1	58.25	235.5
1 p.m.	Chicken broth	150 cc	5.4	0.5	2.25	35.10
	Cocoa	5 gm.				
	With lactose	30 gm.				
	With cream	50 cc				
	With milk	100 cc	5.48	25.44	38.38	404.40
3 p.m.	Buttermilk	200 cc	6.0	1.0	0.58	71.32
5 p.m.	Grape juice	125 cc				
	With lactose	25 gm.	.....	.....	31.25	125.00
7 p.m.	Cream of tomato soup	150 cc	10.65	42.04	41.05	590.56
	Soft-cooked egg	50 gm.	5.95	4.05	.....	65.55
9 p.m.	Hot milk	150 cc	4.95	6.0	7.50	103.80
			50.48	102.93	212.06	1999.73

Time.	From the kitchen.	Amount.	From the floor.	Amount.
7 a.m.	.....	.....	Hot milk	1 glass.
9 a.m.	Oatmeal gruel with milk	1 serving		
	Coffee with cream and sugar	1 cup		
11 a.m.	.....	.....	Orangeade with lactose	1 glass.
1 p.m.	Chicken broth	1 bowl		
3 p.m.	.....	.....	Buttermilk	1 glass.
5 p.m.	Cream soup	1 bowl		
	Soft-cooked egg	1 egg		
7 p.m.	.....	.....	Grape juice with lactose.	1 glass.
9 p.m.	.....	.....	Hot milk	1 cup.

Palatability depends (1) on variation and (2) on the type of food administered. Only two food substances are naturally appetizing and do not require seasoning. These are animal foods and fruits. The use of fruit juices for increasing palatability is well known. The addition of meat extracts for the same purpose may be employed.

The accompanying tables are examples of postoperative dietaries in use at St. Elizabeth's Hospital, Richmond, Va. They are made up on a basis of 2000 calories with a protein intake slightly below 1 gram per kilogram of average body weight. It has been amply demonstrated by various workers, and particularly in reports from the Nutrition Laboratory of Copenhagen, that for limited periods

DIET NO. II.—FEEDINGS EVERY TWO HOURS.

Time.		Amount.	Protein, grams.	Fat, grams.	Carbohydrate, grams.	Calories.
7 a.m.	Chicken broth	100 cc	3.6	0.1	1.5	21.30
9 a.m.	Soft-cooked egg	50 gm.	5.95	4.65	....	65.65
	Oatmeal gruel	100 cc	1.2	0.4	6.3	33.60
	Coffee with cream and sugar (cane)	25 cc 8 gm.	0.55	10.0	8.75	127.20
11 a.m.	Grape juice	150 cc	....	....	37.50	150.0
1 p.m.	Cream of green pea soup	200 cc	15.56	56.88	88.04	806.32
	Orange juice	50 cc				
	With lemon juice	25 cc				
	With lactose	50 gm.				
	With water	150 cc	0.4	0.4	58.25	235.80
3 p.m.	Beef juice	100 cc	4.90	0.69	....	25.0
5 p.m.	Malted milk	12 gm.				
	With cocoa	5 gm.				
	With lactose	25 gm.	4.13	4.30	4.01	191.26
	Soft poached egg	50 gm.	5.95	4.65	....	95.65
7 p.m.	Boiled custard	100 gm.	6.27	6.32	31.35	207.36
9 p.m.	Barley water	200 cc	0.52	0.11	3.64	17.63
			49.03	88.11	239.34	1946.47

Time.	From the kitchen.	Amount.	From the floor.	Amount.
7 a.m.	.....	.....	Chicken broth	1 cup.
9 a.m.	Oatmeal gruel	1 serving		
	Soft-cooked egg	1 egg		
	Coffee with sugar and cream	1 cup		
11 a.m.	.....	.....	Grape juice	1 glass.
1 p.m.	Cream soup	1 bowl		
	Orangeade	1 glass		
3 p.m.	.....	.....	Beef juice	1 cup.
5 p.m.	Chocolate malted milk	1 glass		
	Soft poached egg	1 egg		
7 p.m.	Boiled custard	1 cup		
9 p.m	.....	.....	Barley water	1 cup.

of time the reduction of protein intake to as low as 29 grams per day is without deleterious effects. This is particularly true if the proteins are of "good quality" and if the patient is at rest in bed. The caloric intake is slightly in excess of that usually estimated as required by an individual at rest in bed and therefore provides for a slight gain in weight. The diets are all relatively high in carbohydrates.

DIET NO. III.—FEEDINGS EVERY TWO HOURS.

Time.		Amount.	Protein, grams.	Fat, grams	Carbohydrate, grams.	Calories.
7 a.m.	Orange juice	100 cc	0.8	0.2	28.97	117.28
	Lemon juice	15 cc				
	Lactose	15 gm.				
9 a.m.	Cream toast	30 gm.				
	With milk	100 cc				
	With butter	1 oz.				
	With flour	1 oz.	7.78	12.49	7.45	173.33
	Poached egg	50 gm.	5.95	4.65	....	65.65
11 a.m.	Chicken broth	100 cc				
	With cracker	10 gm.	4.58	1.01	8.81	62.65
1 p.m.	Cream of pea soup	200 cc	15.56	56.88	58.04	806.35
3 p.m.	Oatmeal gruel with milk	100 cc	8.72	8.10	21.83	195.19
5 p.m.	Poached egg on toast	20 gm.	7.87	13.39	10.54	194.15
	Butter	10 cc				
7 p.m.	Baked custard	100 gm.	7.60	6.65	12.50	140.25
9 p.m.	Malted milk	12 gm.				
	With cocoa	5 gm.				
	With lactose	25 gm.	10.39	11.56	48.07	237.88
			69.25	114.03	105.03	2092.81

Time.	From the kitchen.	Amount.	From the floor.	Amount.
7 a.m.	.....	.....	Orangeade with lactose	1 glass.
9 a.m.	Cream toast	1 serving		
	Poached egg	1 egg		
11 a.m.	.....	.....	Chicken broth with cracker	1 glass.
1 p.m.	Cream soup	1 bowl		
3 p.m.	Oatmeal gruel with milk	1 serving		
5 p.m.	Poached egg on toast with butter	1 serving		
7 p.m.	Baked custard	1 serving		
9 p.m.	.....	.....	Chocolate malted milk	1 glass.

Diet No. I is usually the first administered and should be given as soon after operation as the patient's condition safely permits. It corresponds to the so-called liquid diet, although there are included in it such non-liquids as strained oatmeal gruel and a

soft-cooked egg. Diet No. II is used interchangebly with the former and is particularly useful in those cases with milk intolerance or with a tendency to abdominal distention. Diet No. III follows Diet No. I or No. II usually by about two days. When it is found that the patient tolerates the first diet well he may rapidly be changed to the third. In this the feedings are alternated, liquid and semisolid. After an additional day or two, or as long as is necessary in each individual case, Diet No. IV is given, consisting of semisolid food.

DIET NO. IV.—FEEDINGS EVERY TWO HOURS.

Time.		Amount.	Protein, grams.	Fat, grams.	Carbohydrate, grams.	Calories.
7 a.m.	Baked apple	120 cc	0.01	0.58	29.30	124.86
9 a.m.	Wheat farina	100 cc				
	With milk	100 cc				
	With lactose	15 gm.	14.50	5.40	06.30	401.0
	Toast with milk	100 cc				
	Toast	40 gm.	7.12	12.54	7.10	160.74
11 a.m.	Plain junket	100 gm.	3.30	4.0	10.07	127.88
1 p.m.	Creamed fish	50 gm.	17.48	18.83	26.24	344.35
	With white sauce	100 cc				
	Purée of spinach	100 gm.	2.10	4.10	2.60	55.70
3 p.m.	Apricot souffle	.....	0.37	21.56	17.85	290.92
5 p.m.	Chicken broth	100 cc				
	With rice	50 gm.	5.0	0.00	1.50	31.40
	Poached egg	50 gm.				
	On toast	20 gm.				
	With butter	10 cc	7.87	13.30	10.54	194.15
7 p.m.	Stewed prunes	100 gm.	0.50	0.10	22.30	92.10
9 p.m.	Barley gruel with milk	120 gm.	5.04	0.41	13.25	134.45
			70.59	87.51	246.05	2056.55

Time.	From the kitchen.	Amount.	From the floor.	Amount.
7 a.m.	Baked apple	1 large		
9 a.m.	Wheat farina with sugar and milk	1 serving		
	Milk toast	1 serving		
11 a.m.	Plain junket	1 cup		
1 p.m.	Creamed fish	1 serving		
	Purée of spinach	1 serving		
3 p.m.	Apricot souffle	1 serving		
5 p.m.	Chicken broth with rice	1 bowl		
87 p.m.	Stewed fruit	1 serving		
0 p.m.	Barley gruel with milk	1 serving		

The feedings in all four diets are administered every two hours. The directions to the nurse are simplified as shown in the accom-

panying tables, which indicate the amount to be given and whether it is to come from the kitchen or is to be made up by the nurse in the ward.

The advantages of these four groups of diets are as follows: (1) A graduated increase in feedings is provided for each uncomplicated case; (2) the diets are composed of the proper proportions of protein, fat and carbohydrate; (3) the nourishing value is high; (4) all diets are sufficiently varied and are palatable.

In practical experience we have found the diets to be satisfactory. No striking advantage over the usual method of feeding is to be seen in the average postoperative case. It is particularly in those cases which develop untoward complications with prolonged convalescence that the comparative advantages become apparent. Nevertheless, we have observed that patients placed on these dietaries are much more content than others treated by the usual method. This paper is in the nature of a preliminary report and will be followed by a comprehensive comparison of the results from the two methods, a comparison of the weight curves and a discussion of the influence on postoperative conditions such as albuminuria and acetonuria.

We would particularly emphasize that in postoperative treatment the diet must be individualized. Every patient is a law unto himself. The patient's likes and dislikes should always be consulted and agreeable food substituted for that which is distasteful. This can easily be arranged in our diet. The dietaries above described will be relished by the majority of individuals, but when necessary substitution should be freely employed provided care is taken not to change the relative proportion of protein, fat and carbohydrate and not to alter markedly the caloric value.

Mendel has said: "Unfortunately, rational dietetics founded upon the newer knowledge of the chemistry of foods and nutrition has not yet received the discriminating study and advocacy on the part of practical clinicians that its importance unquestionably warrants." This paper is a plea for the rational application to practical medicine and surgery of the more recently demonstrated scientific facts in physiology and biochemistry and for the elimination of those principles which have already been proved to be in error.

REFERENCES.

1. Bnteman, W. G.: The Use of Raw Eggs in Practical Dietetics, Am. Jour. Med. Sci., 1917, 153, 841.

2. Friedenwald and Ruhrah: Diet in Health and Disease, W. B. Saunders Company, Philadelphia, 1909.

3. MacLeod, J. J. R.: Physiology and Biochemistry in Modern Medicine, C. V. Mosby, 1919, second edition.

4. McCollum, E. V.: The Part Played in Diet by Food Substances of Unknown Nature, Oxford Medicine, 1920, 1, 435.

5. Mendel, L. B.: Food Factors in Gastro-enterology, Am. Jour. Med. Sci., 1919, 158, 297.

6. Van Slyke, D. D.: The Chemistry of the Proteins and their Relation to Disease, Oxford Medicine, 1920, 1, 251.